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Strain distribution during slow cooling of a partially molten middle crust. Insights from the neoproterozoic Ribeira-Araçuaí collisional belt

M. Mondou (1,2), A. Vauchez (2), M. Egydio-Silva (1), P. MoniÈ (2), O. Bruguier (2), M. Babinsky (2)

(1) Instituto de Geociências - Universidade de São Paulo – Brazil, (2) Geosciences Montpellier - Université Montpellier II - CNRS - France

The neoproterozoic Ribeira-AraÁuaÌ orogen (SE Brazil), comprises a stack of allochthons containing large amounts of anatectic and magmatic rocks. The upper allochton (∼300km long, 50-100km wide, and >10km thick) involves peraluminous diatexites and leucogranites resulting from partial melting of the middle crust. It overlies another allochthon containing huge early- to syn-collisional plutons intruded in metasediments. The basal allochtonous unit comprises HT-LP (∼750∞C; ∼600MPa) mylonites in which synkinematic leucogranites veins were injected along the foliation. The entire allochtonous domain is thrust upon the S„o Francisco craton. Several lines of evidence are presented that constrain the thermo-mechanical evolution of this orogenic domain. Structural mapping involving ASM measurements suggest that a coherent deformation was recorded in the solid, magmatic or anatectic rocks of the various units. Strain repartition is rather homogeneous and there is no evidence of strain localization. U-Pb ages between 580-570 Ma suggest that the deformation in the basal HT mylonites, in the plutonic bodies of the central unit and partial melting and deformation in the anatexites of the upper unit are contemporaneous. ^{40}Ar-^{39}Ar ages on amphiboles and biotite suggest slow cooling (<5∞C/Ma) from the peak metamorphism temperature (700-800∞C) to the closure temperature of biotite.

In summary, during the collision between the South America and Africa protcontinents, the northern Ribeira-AraÁuaÌ orogenic domain was characterized by an

anormally high thermal gradient (∼35∞/km) that resulted in a widespread partial melting of the middle crust. This thermal regime is associated with injection of huge volumes of plutonic rocks (mostly tonalites) in the central domain. There is no obvious strain localization and deformation in magmatic rocks is similar to deformation in solid rocks. Cooling was slow and magmatic and anatectic materials may have remained so a long time before they solidify. Gravity-driven deformation is not obvious although a combination of plate tectonic and gravity driven deformation is possible.